Journal of the Royal Society of Arts

NO. 4944 FRIDAY, 4TH FEBRUARY, 1955 VOL. CIII

FORTHCOMING MEETINGS

MONDAY, 7TH FEBRUARY, at 6 p.m. The first of three CANTOR LECTURES on '*Some Aspects of Music*', entitled '*Music in Education*', by W. Greenhouse Allt, Mus.D., F.T.C.L., F.R.C.O., Principal, Trinity College of Music. (The lecture will be illustrated with a film, lantern slides and recordings.)

TUESDAY, 8TH FEBRUARY, at 7.30 p.m. FILM EVENING. '*The Back of Beyond*' and '*The Culbin Story*'. (Full details were announced in the last issue of the *Journal*.)

WEDNESDAY, 9TH FEBRUARY, at 2.30 p.m. PERCY SMITH MEMORIAL LECTURE. (Jointly with the Faculty of Royal Designers for Industry.) '*Public Lettering*', by Christian Barman, R.D.I., F.R.I.B.A., Publicity Officer, British Transport Commission. F. J. Stratton, C.B.E., M.A., Chairman and Managing Director, Messrs. Upsons, Ltd., will preside. (The lecture will be illustrated with lantern slides.)

MONDAY, 14TH FEBRUARY, at 6 p.m. The second of three CANTOR LECTURES on '*Some Aspects of Music*', entitled '*Music in the Theatre*', by Leslie Bridgewater, Music Adviser, Shakespeare Memorial Theatre, Stratford-on-Avon, and Musical Director, H. M. Tennent, Ltd. (The lecture will be illustrated with the aid of piano and gramophone.)

WEDNESDAY, 16TH FEBRUARY, at 2.30 p.m. '*Welfare in a Large Family Firm*', by the Honble. H. A. Cozens-Hardy, J.P., D.L., a Managing Director of Pilkington Brothers, Ltd. Sir Harold West, C.I.Mech.E., F.I.I.A., J.P., Vice-Chairman and Managing Director, Newton Chambers & Co., Ltd., will preside. (The paper will be illustrated with lantern slides.)

THURSDAY, 17TH FEBRUARY, at 6.30 p.m. DISCUSSION on '*Equality of Educational Opportunity: with special reference to Comprehensive Schools*'. (See special notice on page 148).

MONDAY, 21ST FEBRUARY, at 6 p.m. The last of three CANTOR LECTURES on '*Some Aspects of Music*', entitled '*Music in Medicine*', by Frank Howes, M.A., F.R.C.M., Music Critic of *The Times*. (The lecture will be illustrated with gramophone records.)

WEDNESDAY, 23RD FEBRUARY, at 2.30 p.m. FERNHURST LECTURE. '*Virus Diseases of Plants*', by F. C. Bawden, M.A., F.R.S., Deputy Director, and Head of the Plant Pathology Department, Rothamsted Experimental Station. Sir James Scott Watson, C.B.E., M.C., LL.D., D.Sc., lately Chief Scientific and Agricultural Adviser, Ministry of Agriculture, will preside.

THURSDAY, 24TH FEBRUARY, at 5.15 p.m. COMMONWEALTH SECTION. '*Music in Africa*', by S. Hylton Edwards, Assistant Director of Music, St. John's College, Johannesburg. Edric Cundell, C.B.E., Principal, Guildhall School of Music and Drama, will preside. (The paper will be illustrated with the aid of piano and gramophone.)

WEDNESDAY, 2ND MARCH, at 2.30 p.m. '*Business as Patron in the Industrial Age*', by F. C. Hooper, B.Sc., Managing Director, Schweppes, Ltd. Sir Francis Meynell, Master, Faculty of Royal Designers for Industry, will preside.

Fellows are entitled to attend any of the above meetings without tickets and may also bring two guests. When they cannot accompany their guests, Fellows may give them special passes, books of which can be obtained on application to the Secretary.

EVENING DISCUSSION MEETING

A second Evening Discussion Meeting will be held, on the same lines as the first meeting which took place on 20th January, on Thursday, 17th February, at 6.30 p.m. The subject will be '*Equality of Educational Opportunity: with special reference to Comprehensive Schools*', and the discussion will be opened by Miss Margaret Miles, B.A., Headmistress of Putney County Grammar School (Girls). Sir Edward Crowe, K.C.M.G., a Vice-President of the Society, will preside. Light refreshments will be available for those attending from 5.45 p.m. for one shilling.

A short report of the first discussion meeting is given on page 150.

OFFER OF ENDOWED PRIZES, 1955

The Society, as Trustee for the undermentioned endowments, offers the following prizes during the year 1955:

HOWARD PRIZE FOR MECHANICAL MOTIVE POWER

The Howard Trust was established in 1868 for the purpose of making awards periodically to the authors of treatises on steam or other motive agents, and a prize of £50 will be awarded to the author of a treatise on some aspects of the subject of mechanical motive power.

BENJAMIN SHAW PRIZE FOR INDUSTRIAL SAFETY

The Benjamin Shaw Trust was founded in 1876 'for the promotion of improvements in all matters relating to unhealthy and dangerous occupations', a subject

in which the Royal Society of Arts has taken a practical interest ever since its foundation in 1754. A prize of £20 is offered in accordance with the terms of the Trust 'for any discovery, invention, or newly devised method of obviating, or materially diminishing any risk to life, limb or health, incidental to any industrial occupation, and not previously capable of being so obviated or diminished by any known and practically available means'.

Entries may be in the form of descriptive essays or models.

FOTHERGILL PRIZE FOR FIRE PREVENTION OR FIRE-FIGHTING

Under the Fothergill Trust (established by the will of Dr. Fothergill in 1821) a prize of £20 is offered for a descriptive essay or model embodying some new idea for the prevention or suppression of fire.

Conditions of Entry

(1) Entries for the above prizes must be received by the Secretary of the Society not later than 31st July, 1955, and must be clearly marked with the entrant's name and address, and the prize for which they are submitted. Essays must be typewritten.

(2) The Society cannot accommodate bulky apparatus for judging. Such entries must be submitted by means of written descriptions or models, but the Society may subsequently require a demonstration with the actual apparatus.

(3) The Society reserves the right to divide or withhold all or any part of the above prizes, should the quality of the entries, in the opinion of the judges, justify such a course.

(4) The Society reserves the right to exhibit or publish any entries (the copyright being retained by the competitor).

(5) The Society cannot accept any responsibility for the safety of papers or models submitted to it for the purpose of these awards.

(6) The decision of the Council of the Society regarding all matters connected with the awards will be final, and correspondence cannot be entered into regarding the reasons for any decisions it may take.

The Council is anxious to give the widest possible publicity to these offers and would therefore appreciate any assistance which Fellows may be able to give in making them known. Copies of the particulars for distribution will be sent on request.

DESPATCH OF JOURNALS IN ENVELOPES

Special arrangements for posting *Journals* flat in envelopes instead of in the usual postal wrappers are made in cases where Fellows require, for subsequent binding purposes, that their *Journals* should arrive unfolded. Fellows wishing to take advantage of this arrangement are asked to notify the Secretary.

THE FIRST EVENING DISCUSSION MEETING

'TELEVISION—FRIEND OR FOE'

A considerable number of Fellows and their guests attended the discussion meeting held in the Library on Thursday, 20th January, which was the first of the new and experimental series of evening meetings.

The subject for discussion was introduced by Mrs. Mary Adams, O.B.E., a Senior Official of B.B.C. Television Service (Direction), who spoke of the problems and possibilities facing television in the foreseeable future. Mrs. Adams mentioned the difficulties of providing programmes for a large mixed audience of viewers and hoped that the future would bring a greater variety of more selective programmes. With the development of Eurovision, programmes would be exchanged and relayed over a wide area. She also considered the effects television might have in increasing appreciation of art and design, and mentioned the power of television to give a new sort of prominence to the personalities it displayed.

During the general discussion which followed, the effects of television on literature and education were considered and it was suggested that any ill effects that might be caused to these interests might be offset by the new approach which television would make possible to them.

It was suggested that television might engender a passive approach to instruction and entertainment, and that it might lead to the unquestioning acceptance of ideas, since it was not possible to react positively to or argue with it. This characteristic might make it an inferior teacher; its ability to give instruction in certain subjects which depended largely on visual demonstration was conceded.

The effect of television on home life was much discussed and the possibility of television having a destructive effect on the coherence of family life since the same programme was not likely to please all members of the household was stressed.

The general feeling of the meeting was that television must be accepted as a new and powerful force in private and public life. The introduction of alternative programmes, if they were used to provide a variety of opinion, should produce safeguards against abuse. Not the least of its virtues was its power to give viewers a direct visual knowledge of people, places and affairs which might otherwise be not available to them.

Those who took part in the discussion included Mr. Louis Golding, Dr. A. J. McIntosh, Principal, City of London College, Mr. Edwin Newman, National Broadcasting Company Incorporated, Mr. F. S. Height, Mr. John Crisford, Mr. O. A. Batten, Mr. A. C. Chappelow, Mr. Hamid Ali, Mr. J. Davids, Mr. Kenneth Rick, Mr. W. J. Abel, Mr. K. Besser, Lady Moore-Guggisberg, Mr. P. Norman, Mr. Llewellyn Rees and Mr. G. W. H. Gibbs.

The meeting was presided over by Lord Radnor, past Chairman of Council of the Society, who in concluding the discussion thanked those who had attended for their part in providing a most successful start to this new series of meetings.

THE INSULATION OF SUBMARINE TELEPHONE CABLE

The Llewelyn B. Atkinson Memorial Lecture by

J. N. DEAN, B.Sc., A.R.I.C., F.I.R.I.,

Chairman and Managing Director, Submarine Cables, Ltd.,

delivered to the Society on Wednesday, 1st December, 1954,

with P. C. Allen, of Imperial Chemical Industries, Ltd.,

in the Chair

THE CHAIRMAN: This afternoon we are to hear the second Llewelyn B. Atkinson Memorial Lecture. The first was given by Dr. Dunsheath in 1943, when he gave some account of the story of Llewelyn B. Atkinson, the subject of this memorial. I shall therefore content myself by saying only that he in whose honour we are met to-day was pre-eminent in seeking the application of science to industry and especially to the electrical industry. I have a few more remarks that I might appropriately make this afternoon, but I think that they would perhaps come better after the lecture has been given.

The following lecture which was illustrated with a film was then delivered:

THE LECTURE

On the 15th March, 1944, the author had the honour and pleasure of reading a paper[1] to the Society, the subject matter of which was gutta percha and balata, with particular reference to their use in submarine cable manufacture. In that paper he endeavoured to give an historical survey of the products and a description of their physical and mechanical properties, which rendered them so suitable for the insulation of under-water cables. He also described their botanical origin and the methods of extraction from the trees, and the manufacturing processes employed before the gutta percha could be used in the industry. It was early in the 1850s that gutta percha was successfully used to insulate submarine cable, and it is still being used to-day to repair the many thousands of miles of undersea telegraph cables which link the continents of the earth.

It is not intended again to go deeply into the history of the subject of that paper, but it is interesting to refer to the concluding paragraph of the earlier paper, which was as follows:

> Perhaps the best method by which a paper of this type can be concluded is to set out the comparative advantages and disadvantages of the old type submarine cable insulation—gutta percha and balata—beside those of the new competitor, polyethylene. The following Table has been prepared with this object:

COMPARISON OF GUTTA PERCHA WITH POLYETHYLENE

Characteristics	*Commercial Gutta Percha*	*Polyethylene*
Resistivity	1×10^{11}	1×10^{17}
Permittivity at 2,000 cycles/s, 0° C.	3·1 (rising with age)	2·3 (constant with age and frequency)
Power factor at 2,000 cycles/s, 0° C.	0·01 (rising with frequency)	0·0005 or less (constant with frequency)
Chemical stability ..	Oxidizes easily—must be stored under water	No deterioration under normal conditions—can be stored dry or wet.
Safe working temperature	40° C.—45° C. (must be kept cool during shipment and laying)	70° C.—80° C. (can be stored on deck)
Water absorption	1·5%—3%	Substantially nil.
Weldability for joint making	Good	Excellent.
Price	High—say 100	Moderately high—say approx. 75. (G.P. equals 100)
Teredo resistance ..	Bad	Unknown but probably bad.*
Past experience	Excellent	Good as far as is known.

It is possible to look back upon the last hundred years as a period of intense development of the use of gutta percha and balata, particularly in the cable industry. During these years, telegraph communications over long distances have been dependent almost entirely on the application of gutta percha and balata, and it is not too much to say that world communications, and consequently world development, would have been very seriously retarded had it not been for the discovery of the peculiarly important properties of gutta percha, particularly for the insulation of submarine cables. The introduction, however, of modern synthetic polymerized thermoplastic hydrocarbons, and, in particular, polyethylene and polyisobutylene, very materially alters the position of gutta percha in this field.

It is interesting to note that now, ten years after the paper was written, the concluding sentence, read in conjunction with another sentence appearing a little earlier in that paper, 'Its [gutta percha's] future in the industry lies only as a material for repairing existing cables', has been borne out by fact, and to-day all new cables are insulated with polyethylene.

* At the time this table was compiled it was expected that polyethylene would be attacked by teredos at least as badly as is gutta percha. Experience has since shown, however, that the attack is not unduly serious and that the conventional means of prevention are entirely satisfactory.

COMPARISON BETWEEN GUTTA PERCHA AND POLYETHYLENE

Let us examine a little more closely the interesting properties of the material used to-day, polyethylene, and consider how it compares in general characteristics with the earlier material, generally classified as gutta percha and including purified products derived therefrom, namely Paragutta and K-Gutta.

Similarity

Examining first the points of similarity, the following is found:

(*a*) Both are perfect thermoplastics, that is to say they can both be heated to a moderate temperature, moulded to shape and cooled to retain the new shape, and this, within reason, can be repeated as often as required.

(*b*) Both, at air temperature, are firm, leathery materials, not easily distorted by pressure, but fairly easily bent.

(*c*) Both are elastic at very low stress, but having a comparatively low yield point they can be easily stretched.

(*d*) Both, when stretched to near breaking point, behave as if they have a 'memory' and quickly shrink back, or retract, on being heated, due of course to molecular alignment caused by the linear stress—a 'frozen-in' uniaxial stress.

(*e*) Both materials have a very low water absorption and comparatively high resistance to water diffusion.

(*f*) Both materials have low dielectric constants and high dielectric resistivity, which are unaffected, or only slowly affected, by immersion in water.

(*g*) Both materials are high molecular weight hydrocarbon materials of complicated molecular structure, evidencing both crystalline and amorphous characteristics as shown by X-ray analysis.

(*h*) Both are subject to oxidation, particularly if exposed to sunlight, but in both cases the deterioration can be inhibited by various means.

(*i*) Both become brittle at low temperatures.

Difference

Now for their points of difference:

(*a*) Polyethylene requires a temperature above the boiling point of water to soften it. Gutta percha softens at a temperature often met in tropical countries, or even on hot days in England. The actual temperature varies with the type of gutta percha.

(*b*) The water absorption and diffusion of polyethylene are considerably less than those of gutta percha, so that the electrical properties are even more stable than those of gutta percha.

(*c*) The dielectric properties of polethylene are vastly superior to those of gutta percha, particularly when operating at high electrical frequencies, i.e. speech frequencies upwards.

(*d*) Polyethylene is chemically more inert than gutta percha, and it is therefore easier to prevent its oxidation by protection from light and/or the admixture of a suitable anti-oxidant.

(*e*) Polyethylene is harder, stronger and generally more robust than gutta percha.

(*f*) Polyethylene is considerably cheaper than gutta percha, and this, combined with its lower density, makes it far more economical than gutta percha.

(*g*) Polyethylene is a synthetic material and can be prepared under controlled conditions to provide perfection and controlled variation of quality not attainable in the case of gutta percha.

Adverse characteristics of polyethylene

So far, all the points of difference are in favour of polyethylene, but there are one or two properties of polyethylene which have been difficult to control, and which have caused considerable trouble in its use.

(a) *Surface cracking:* It is subject to microscopic surface cracking, usually known as 'environmental cracking', when in contact with many liquids—usually those of a polar nature—and when the exposed sample is bent these cracks

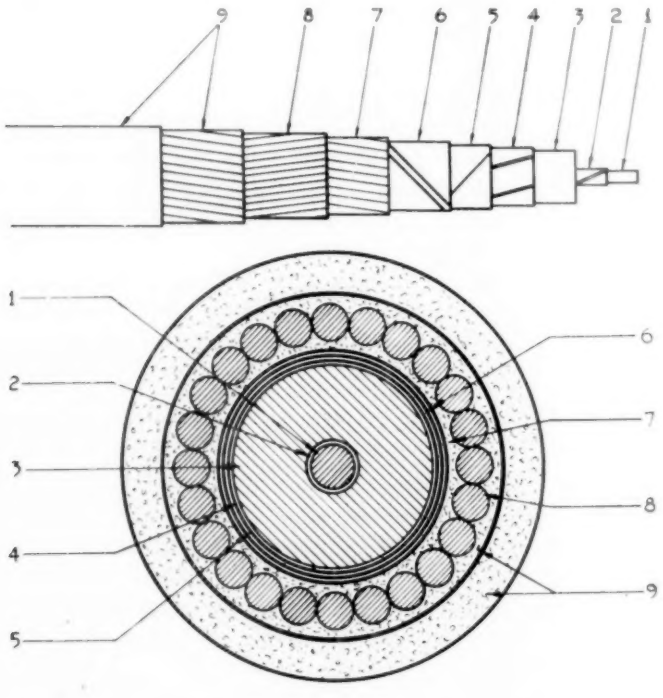


Diagram showing the construction of the deep sea section of the transatlantic telephone cable and its cross-section: 1. *Centre conductor,* 0·1318 *in. diameter copper;* 2. *Three* 0·0145 *in. copper surround tapes;* 3. *Polythene to* 0·620 *in. diameter;* 4. *Six* 0·016 *in. copper return tapes;* 5. 0·003 *in. overlapped copper tape;* 6. *Gapped Telconax tape;* 7. *One serving of cutched jute;* 8. *Twenty-four* 0·086 *in. diameter high-tensile steel armour wires;* 9. *Two impregnated-jute servings*

develop in an intercrystalline manner, so that it becomes apparently brittle.

This environmental cracking is dependent upon molecular weight and molecular structure. Little is, as yet, published about the latter, but by modifications to the production methods of the polyethylene itself it has been found possible to control the molecular weight and structure, and by suitable control of the extrusion conditions the degree of 'frozen-in' stress can be varied so as to reduce environmental cracking to a minimum, and in fact for all practical purposes, so far as submarine cable work is concerned, to eliminate it altogether.

Broadly speaking, the tendency towards environmental cracking becomes less the higher the molecular weight of the polyethylene. It has become customary in England to refer to grade numbers of polyethylene instead of to the molecular weight. The grade number, or 'melt index' as it has also been called, is an inverse function of the viscosity of the molten polyethylene, and is an arbitrary figure determined by the flow of polyethylene through a carefully defined orifice for a definite time at a definite temperature.[2] The higher the grade number, the lower the viscosity and the molecular weight and therefore the quality. This is unfortunate since it causes a risk of serious ambiguity. To avoid it the author proposes to use the expression 'hard grade and soft grade' wherever possible.

In the early stages of production by Imperial Chemical Industries, the inventors, a soft and variable grade of polyethylene was supplied, and environmental cracking was a very serious feature. In England there became a tendency to overcome the trouble of both variability and high grade number by adding a large proportion—up to 25 per cent—of one of the very few known diluents of polyethylene, namely polyisobutylene. Polyethylene and polyisobutylene (P.I.B.) appear to be completely miscible in all proportions, and the P.I.B. being itself a high polymer and having a rubbery yet plastic nature acts as a plasticizer to the polyethylene, and at the same time provides a very considerable protection from environmental cracking. In America, and latterly in Britain, the tendency has been to use harder and harder grades of polyethylene and so reduce the tendency for environmental cracking to occur. Nevertheless, in recent years the British precaution of employing some diluent such as P.I.B. or butyl rubber is tending to become an international means for safeguarding against environmental cracking in submarine cable work. It is unfortunate that no name has been universally adopted for admixtures of polyethylene with other substances. The author's company has always employed the name 'Telcothene' to include all varieties of plasticized polyethylene, and this name will be used in the remainder of this paper where applicable.

(b) *Extrusion:* Owing to the much higher melting point of polyethylene compared with gutta percha, and the high temperatures necessary for its extrusion (particularly when hard grades are employed), the tendency to oxidize is increased, and it has been difficult to find a suitable anti-oxidant,* which will not destroy or even deteriorate to the slightest extent the essentially desirable electrical characteristics of the material. This difficulty has now been overcome,

*An anti-oxidant is a substance which, if added in very small quantities, will, by a sort of anticatalytic process, prevent or reduce oxidation.

and to-day a material is available which, for all practical purposes, is stable even at the high temperature of 275° C. which is necessary to extrude the hardest grades.

When polyethylene was first introduced, partly because the problem of oxidation was not solved, partly because the material was variable from batch to batch and was soft, and partly, again, because appropriate machinery was not available, 87½ per cent of polyethylene was admixed with 12½ per cent of P.I.B. to make Telcothene. This material was found to be suitable for extrusion by the traditional gutta percha extruders, after slight modifications, and moreover the standard gutta percha machinery for mixing and pre-heating prior to extrusion produced an ideal product.

There have been many criticisms of this procedure, particularly from America, but it is, in the author's view, only comparatively recently that the cold feed screw type extruders have been of a quality capable of manufacturing continuous lengths of fault-free insulation suitable for modern submarine telephone cable. 'The proof of the pudding lies in the eating.' Thousands of miles of cable lie at the bottom of the sea having a core insulated with Telcothene, and are giving satisfactory service, though little or no attempt was made to avoid environmental cracking by separating the Telcothene from contact with other substances such as cable compounds.

(c) *Knuckling:* Most cable makers know that at times, for no apparent reason, certain types of cable (not necessarily submarine cable) will fail, and when examined it will be found that the conductor is broken, and on rare occasions one or both ends of the conductor will protrude through the insulation. Usually this occurs where there is a comparatively strong insulating material and a single and rather weak conductor. Experience of this type of fault has been found in certain varieties of polyethylene-insulated cables for radar operation, particularly those cables insulated with straight polyethylene as opposed to Telcothene. Until 1948, however, such a fault had not developed in submarine cable core. During 1948, when Cable and Wireless, Limited, were laying one thousand nautical miles* of the renewal of their St. Vincent—Pernambuco cable in very deep water (2,500 fathoms or 15,000 feet) and in very trying weather conditions, it became necessary during the operations to buoy an end of the cable on the surface, and after forty-eight hours, when the ship returned to pick up the end, it was found that a fault had developed. On inspection it was found that the copper conductor had broken and forced itself through the insulation and even between the armouring wires (these are laid quite close together) so that a length of an inch or more of bare conductor was exposed. At first sight this would seem impossible, but after careful study, with a full appreciation of what occurs when laying cable, and more particularly when one end is free-buoyed, the following became clear.

When a cable is strained, as it is under the stress of laying and still more when picking up, the cable itself stretches, armouring wires and all, partly elastically and partly by rotating, so unwinding the turns of the armour wires. The core,

*One telegraph nautical mile or naut = 6,087 feet = 1·150 statute miles (approx.).

which is virtually free to slide inside the armouring, may under these conditions stretch considerably at any one place, and the conductor (fully annealed copper) will be stretched beyond its elastic limit, but the insulation material (in this case polyethylene) is quite elastic up to even 40 per cent strain and has a considerable retractive strength. When the strain is released the armouring wires and the elastic insulation will retract, but the non-elastic copper will not, and can only accommodate itself by buckling very sharply, sometimes, as in the above-mentioned case, even fracturing, and so cutting and forcing itself through the insulation. Gutta percha being softer, less elastic and of low retractive strength, will—so to speak—ripple with the conductor and this type of fault does not develop.

A vast amount of experimental work[3] has been carried out since 1948 involving a large number of tests upon cable cores of different design, and the tests involved the use of two cable-laying machines, one working against the other, to simulate laying operations. By modifying conductor design and adopting special armouring conditions a completely knuckle-free cable of all sizes and for different purposes can now be designed with complete safety.

Before closing this section on characteristics it would seem desirable to include some tables of properties of polyethylene. The first provides figures which are substantially correct for all grades of polyethylene normally used, and the second gives data depending on grade, i.e. related to average molecular weight:

TABLE I. PROPERTIES OF POLYETHYLENE NOT VARIABLE WITH GRADE

Density, 20°C.	0·92 gm/cm³
Thermal conductivity, 20°C.	0·0007 cal./cm. sec. °C.
Specific heat, 20°C.	0·55 cal./gm. °C.
Cubical thermal expansion, 0 to 40°C.	0·0006 per °C.
Refractive index, 20°C.	1·51
Melting point	111°C.
Dielectric constant, 20°C., 10 to 10^{10} c/s.	2·28
Power factor (tan δ), 20°C., 100 Mc/s.	0·0002
Volume resistivity, 20°C. (after one min.)	10^{17}—10^{18} ohm-cm.
Surface resistivity, 20°C., 75 per cent R.H.	10^{14}—10^{15} ohms
Dielectric strength, 20°C. (to B.S. 771)	400 kV/cm.

TABLE II. PROPERTIES OF POLYETHYLENE VARIABLE WITH GRADE

Grade number		0·2	20
Tensile strength	lb./in²	2500	1500
Elongation at break	per cent	>600	450
Low temperature brittle point	°C.	—100	—30
Environmental cracking (accelerated test in oils, etc.)		immune	severe cracking

APPLICATION OF POLYETHYLENE TO SUBMARINE CABLE

Early work[4]

It was in 1933 that Imperial Chemical Industries, Limited, first discovered a white powder in a reaction vessel as a result of experimenting with ethylene gas at extremely high pressures. This work was carried out purely as a research contribution to science and with no expectation of an industrial product. The whole matter nearly finished there, since no one seemed to think this powder, which melted to a paraffin wax-like mass, had any serious value. In fact, it was considered by some as a most expensive way of making candle grease, particularly as at that time the cost must have been many pounds sterling per ounce. A chance remark a little later by one of the research team gave the clue that it might be considered as a synthetic gutta percha. This was seized upon by the Telcon group, not so much at that time with a view to its use as an insulant to submarine cables—for it looked as though it would be too expensive—but because, owing to its chemical structure, it was likely to fulfil a vital need as an insulant for cable for radar (then called radio location) for operation at very high frequencies.

By 1939 experimental types of high frequency cables were designed and soon afterwards standardized. For this purpose modified gutta percha-type extruders were used and for several of the most vital early years of the Second World War, all the cables for radar were made on these machines in the Telcon factory. So vital was polyethylene in this period that after the war the author was informed by Germans, who had not discovered how to make polyethylene, that they depended for their supplies upon shot-down Allied bombers. These supplies were made to go a long way by heavy dilution with German-made P.I.B. or Oppanol. Thus not only was Telcon supplying the entire Allied Forces with Telcothene-insulated radar cables, but it was supplying the Germans too.

At the same time, the possibilities for future undersea high speed carrier telegraph and telephone cables were not forgotten, and the possibility of the application of undersea repeaters to long line telephony development was appreciated.[5] The future of submarine telephone cables was dependent upon the right insulating material, preferably reasonable in price, and polyethylene looked like a possibility. In the late 1930s an experimental length of polyethylene-insulated submarine cable core was made and submitted to the British Post Office, and a counter length was kept at the Greenwich factory of Submarine Cables, Limited. Though one of these lengths was faulty (surface cracking) the other length has been under test ever since and still remains satisfactory. In fact, the first samples of polyethylene have been immersed in aerated water for over twenty years, and the power factor (a very sensitive method for the detection of oxidation) has only just begun to show a rise. Seeing that the early production was, by modern standards, very poor and no anti-oxidant was used, this result is an extremely good index of the expectancy of life of polyethylene-insulated submarine cable. Incidentally, under these conditions purified gutta percha would be faulty and brittle in six to seven years. Furthermore, it is interesting to note that the environmental crack, which developed in the sample length made

for the British Post Office, led to the introduction of the use of P.I.B. and the name Telcothene.

Since then over 16,000 nautical miles of Telcothene-insulated submarine telegraph and telephone cable, involving nearly 20,000 nautical miles of core, have been made in this country for many different users. Because the polyethylene type cable is cheaper, a large milage has been used for the repair or replacement of purely telegraph cables, originally insulated with gutta percha.

Early in the Second World War a large amount of cable was made for controlling minefields, and later for repairs to the submarine telegraph network, but by 1944 sufficient of the jealously rationed polyethylene supplies had been allocated to enable a stock of upwards of one thousand nautical miles of coaxial telephone cable to be built up ready for the invasion of France. Within a day or so of D-Day the first of these cables was laid. Others followed, as the Allied advance continued, and H.M.T.S. *Ariel* laid two Telcothene-insulated cables between Cuckmere and Dieppe in September, 1944, each providing twelve telephone circuits.[6]

Recent applications of Telcothene

An interesting application of Telcothene has been to the 325 nautical miles of coaxial cable laid between Weybourne and Denmark in 1950 and this carrier frequency telegraph cable is now carrying 72 teleprinter circuits. There are now quite a few telephone coaxials with submerged repeaters in operation, the longest in existence and the most recently made being the cable between Scotland and Norway (Aberdeen—Bergen) of over 300 nautical miles in length and having seven repeaters to provide 36 telephone circuits. The installation of this cable was completed by H.M.T.S. *Monarch* in October this year.

Now all submarine cable 'eyes' are on the transatlantic cable system to be completed in 1956. It is not proposed to deal with the subject in detail, because

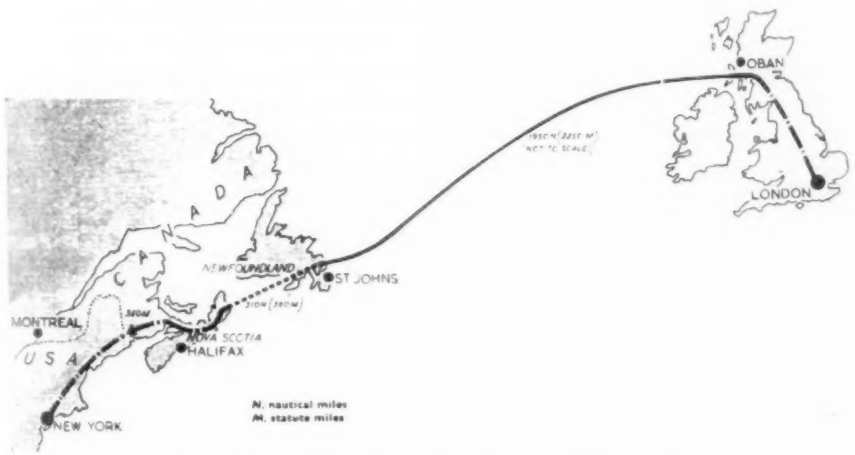


Diagram of the route of the transatlantic telephone cables

a paper[7] by Kelly, Radley, Gilman and Halsey was given to the Institution of Electrical Engineers for discussion on the 4th November, the subject of the paper being 'A Transatlantic Telephone Cable'. Suffice it to say that this transatlantic project provides 35 telephone circuits and envisages the use of submerged repeaters of both the Buckley or Bell Laboratories type,[8] housed in a flexible or articulated casing, and also the British Post Office type, housed in a rigid casing. The flexible types amplify only one way, and so involve two cables, each about 2,000 nautical miles long, between Scotland and Newfoundland and containing 52 repeaters in each cable—104 in all. The rigid types being both-way amplifiers involve only a single cable to connect Newfoundland and Nova Scotia—a distance of about 320 nautical miles and involving sixteen repeaters. The route to be followed is shown in the map on the previous page.

The cable construction is fully described in the above-mentioned paper, and in general principle is of normal coaxial type. In detail, however, very special precautions have been introduced to control quality and dimensional limits to a degree not envisaged earlier, and involving the employment of revolutionary methods of production. So revolutionary are these methods that Submarine Cables, Limited, who have been entrusted with the supply of the major part of the cable, found it necessary to equip a special factory for the purpose.

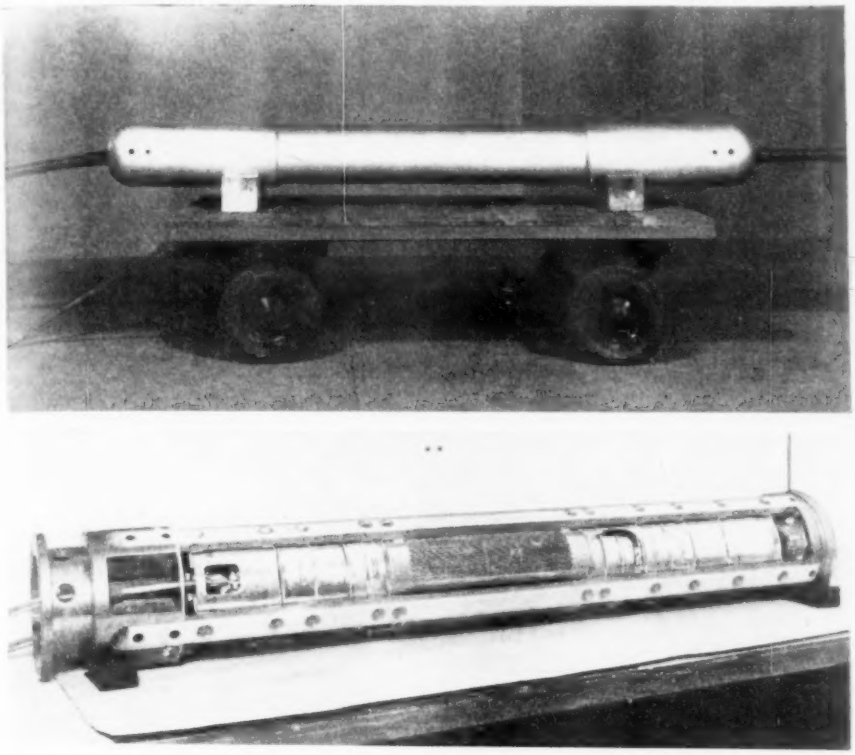
The dielectric material to be employed consists of a very hard grade (0·3) polyethylene with 5 per cent of butyle rubber, and the outer diameter of the Telcothene core is 0·620 inch.

The extreme accuracy of production called for is necessary to ensure that the attenuation between repeaters is just equal to the gain of the repeater at all frequencies in the range of operation (this is 168 Kc/s on the main link and as high as 552 Kc/s between Newfoundland and Nova Scotia). If this is not so—particularly in a system with very many repeaters—discrepancies may result in noise if the error is in one direction, or overloading of the repeaters if it is in the other. This involves a prediction of cable attenuation of each repeater length to an accuracy approaching one part in one thousand. From the point of view of the cable maker considerable research and development has been necessary to provide plant for the manufacture of the conductor and for the processing and extrusion of the dielectric material. Thus Telcothene responds to the exacting processing requirements of a modern submarine cable insulant as probably no other known thermoplastic could do.

SPECIAL CABLE INSTRUCTIONS

Air spacing

This paper would be incomplete without reference to other types of dielectric which have been employed or considered for submarine cable insulation. As early as 1895[10] Mr. Willoughby Smith, then Managing Director of The Gutta Percha Company, foresaw the advantages to be gained in weight and electrical performance by using air as a dielectric, and he designed a composite structure involving an air space for enshrouding the conductor.



Exterior and interior of rigid repeater

This construction was employed for a short cable laid in 1897 between Hampshire and the Isle of Wight in connection with a new telephone line then in course of construction,[11] and the cable was used for some years, but the advantage of the air spacing was lost, due to the effect of the then unknown degree to which water and water vapour could diffuse through a wall of gutta percha despite its low water-absorption.

An air-spaced construction depending upon an extruded sheath was not again employed (so far as the author is aware) for submarine cable manufacture until 1947, when a large and unique cable was laid between England and Holland[12] which had a tube of Telcothene extruded over a spiral of the same material to form an air space.

This cable, about 82 nautical miles long, provided 84 two-way channels, and it has operated successfully since the day it was put into service. There were many who prophesied that such a construction would soon become completely filled with water, because of the diffusion of water (water vapour) through the polyethylene. Systematic studies and tests, however, showed that the osmotic pressure of the salt water more than counterbalances the vapour pressure of the water up

Handling a flexible repeater

to hydrostatic pressures to be found in the shallow depths of the North Sea. The complicated calculations were carried out by the engineers of Submarine Cables, Limited, and the pioneering attitude of the British Post Office engineers became evident in that they backed the scheme, and another successful cable was laid.

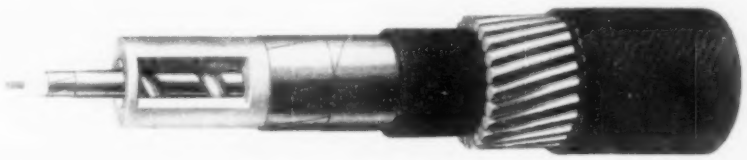
Other air-spaced constructions

Other proposals have involved the use of an air-spaced construction surrounded by a watertight metallic sheath, and a cable of this type was laid in the Baltic, during the war, by German engineers of Felten and Guilleaume Carlswerk of Cologne and Nordenham, involving the use of a spiral of Styroflex[13] (stretched polystyrene) tapes in a lead sheath. It will be realized that the economics of this construction become more difficult as the size of the cable and the depth of the ocean bed increase. Nevertheless, it is claimed that all the mechanical difficulties of pressurization and jointing of such a cable have been overcome, and that at the same time it offers technical and economic advantages over the solid plastic insulation. Certainly these advantages must be of more than a very minor character if the operating engineers are to take the risk of the breakdown of such a delicate structure.

Armourless cable

More recently, consideration has been given to the development of an armourless type of cable, in which the tensile strength necessary for withstanding the strain of laying is provided by the conductor instead of by the outer armouring wires. This forms a very economical cable, and trials are imminent and likely to be successful. Such a cable, coupled with the use of relatively cheap and lightweight repeaters involving, for example, transistors, might open a completely new approach to the economics of intercontinental telecommunication.[14, 15]

It would not seem right to complete this paper without again referring to the very ambitious and much-publicized Atlantic Telephone Cable project. Large sums of money are being spent to enable this project to be completed by 1956, and the eyes of the whole telecommunications world are upon it. If it is successful, and there is no reason to believe otherwise, the amazing network of telegraph



The Aldeburgh-Domburg No. 6 Cable

cables which now encircle the globe and interlink all important continents will ultimately be replaced by coaxial cables to provide telephone, high speed telegraph and facsimile picture transmission; and who knows but that in another ten years, not only speech but television—and in colour too—will be transmitted across the great ocean spans which separate the continents of the earth.

The author wishes to acknowledge the valuable assistance he has received from Sir Gordon Radley in reading through this paper, and from Dr. Smith and the technical staff of Submarine Cables, Limited, in the compilation of the technical data.

REFERENCES

1. J. N. Dean : *Journal of the Royal Society of Arts*, 92, p. 368, June, 1944.
2. *Government Department Electrical Specification No. 27*, 1950.
3. B. F. Thorne : *Telcon House Magazine, No. 15*, p. 1, March, 1952.
4. M. W. Perrin : *Research*, 6, p. 111, March, 1953.
5. O. E. Buckley : *Journal of the Institution of Electrical Engineers*, 89, Part I, p. 454, October, 1942.
6. J. Rhodes : *Post Office Electrical Engineers' Journal*, 38, p. 136, January, 1946.
7. M. J. Kelly, Sir Gordon Radley, G. W. Gilman and R. J. Halsey : *Proceedings of the Institution of Electrical Engineers*, Paper No. 1471 (to be published in Part B).
8. J. J. Gilbert : *Bell System Technical Journal*, 30, p. 65, January, 1951.
9. R. J. Halsey and F. C. Wright : *Proceedings of the Institution of Electrical Engineers*, 101, Part I, p. 167, July, 1954.
10. W. S. Smith and W. P. Granville : *British Patent Specification No. 8573 of 1895*.
11. *The Telcon Story 1850-1950*, p. 81.
12. J. Rhodes : *Post Office Electrical Engineers' Journal*, 41, p. 1, April, 1948.
13. R. A. Goodman : *F.I.A.T. Final Report No. 906*, 16th August, 1945 (H.M. Stationery Office).
14. *Western Union Technical Review*, 7, No. 4, p. 121-8, October, 1953.
15. H.M. Postmaster General : *British Patent Specification No. 703, 782 of 1954*.

GENERAL REFERENCES

1. Bright : *Submarine Telegraphs*, Crosby Lockwood & Son, 1898.
2. C. Swallow : *The Future of Polythene*, British Plastics, September, 1954.

DISCUSSION

MR. K. W. LUCKHURST (Secretary of the Society): I wonder whether I might add a short historical note which may be of interest. I dare say that Mr. Dean referred to this fact in his previous lecture, but it was in this room at a meeting of this Society that gutta percha was first demonstrated in this country. That was on 19th March, 1845. The specimens were sent over by a corresponding member of the Society, Dr. Montgomerie, from Singapore, and Faraday and William Siemens were in the audience, and talked about it afterwards. Faraday then suggested to Siemens that this new material might well be suitable for this very purpose, for submarine insulation.

DR. S. G. FOORD: Can Mr. Dean explain why it has been necessary to put butyl rubber into polyethylene when the temperature to which the cable is exposed is no lower than a few degrees centigrade? I should have thought it rather unnecessary in this case where the temperature is comparatively moderate.

THE LECTURER: I am sorry if I gave the impression that butyl rubber was added with the object of reducing the temperature at which polyethylene became brittle. It certainly does reduce it, but it was originally added because it prevented cracking, for instance, surface cracking, environmental cracking, and general embrittlement in the early types of polyethylene. Butyl rubber also acted as a softener or plasticizer.

DR. S. G. FOORD: Is it still used?

THE LECTURER: Yes, it is still used because it is still found that even with the hardest grades of materials, that is, the highest molecular weight materials, it does have an effect in reducing even further the slightest risk of surface or environmental cracking.

MR. H. F. WILSON: I do not think that Mr. Dean misled the audience with his reference to cracking. Perhaps the previous questioner thought that the word meant cold cracking as opposed to environmental cracking. We did find in those early days that the addition of butyl rubber improved the cold crack resistance of the softer grades of polyethylene, but actually it worked the other way with the very hard types of polyethylene as far as the resistance to low temperature cracking was concerned. There is no doubt that the addition of polyisobutylene or butyl rubber has a most profound effect in preventing the other type of cracking, namely, the environmental type.

MR. C. C. BARNES: The lecturer referred to the possibility of modifying the type of armouring in order to do away with the difficulties experienced when laying the cable. Could Mr. Dean please tell us what length of lay was used, and what were the methods of modifying the type of armouring he had in mind? The other point on which I should like to have details is the so-called armourless submarine cable.

When I was in America recently, I found that the Americans have no case at all for the use of polyisobutylene as we use it in this country. I would like to have the lecturer's comments on this particular point also.

THE LECTURER: I am sorry I cannot remember the length of lay of the cable to which I referred, but by varying the length of lay, the relationship of the diameter of the armoured cable to the core and the spacing of the armouring wires, and, in fact, many factors, including the construction of the conductor, etc., one can reduce the tendency to knuckle to an absolute minimum.

With regard to the armourless cable, I am not in a position to divulge much

information about that, as it is subject to patents. It was merely as a matter of interest that I mentioned it, and I do not think I can go any further.

As to the use of polyisobutylene in America, I am afraid that I am not very up to date in the use of polyethylene and mixtures of polyethylene with other substances in that country, but I believe it is true that it is not normally used, though it certainly is being used with the approval of the Americans for the transatlantic telephone cable, which as you know is the subject of a contract from the Post Office as far as my Company is concerned, but the technical specification is a joint affair between the American and the British authorities, and it was that point that I was referring to.

DR. J. E. SISSON: I have always been fascinated by the subject of repeaters, which Mr. Dean did just mention to-day. I should like to know a little more about the nature of repeaters and their estimated length of life under the Atlantic.

THE LECTURER: I am afraid that I cannot give an adequate answer. You would have to specify the type of repeater and the manufacturer in order to receive a proper answer. As it is really an electrical engineer's subject and as I was formerly a chemist but cannot claim to be even that any longer, I would ask Dr. Smith to answer that question more fully.

I think perhaps I might say this, that it is generally assumed that it is not a sound proposition to imagine a repeater lasting less than ten years, and that it ought to last for twenty. The fact that very reputable firms are backing their ability and are prepared to supply repeaters, though without a guarantee for that length of time, indicates to me that they are confident the repeater will last that long.

DR. E. W. SMITH: My knowledge about repeaters is mainly secondhand, because I have never actually built or controlled the building of a submarine cable repeater myself, although I have assisted in the testing of a good many. If the last speaker would like to obtain the experiences of actual engineers he should obtain a copy of the paper referred to by Mr. Dean in which some particulars are given.

Roughly speaking, a three stage repeater has an amplification of between 50 and 60 decibels. This is a conservative rating so that, as Mr. Dean has mentioned, the repeater is not likely to be noisy, and can deal with reasonable variations from normal level. We then have a 50 or 60 decibel repeater which is built either into a long snake-like structure, or into a short stout cylinder. The principle is the same: in the former, the components and wiring have to be strung out in the long flexible casing, and electrical convenience is sacrificed to mechanical convenience; in the latter, in the lump type of repeater, the electrical circuit engineer has made himself as comfortable as he can and made the mechanical engineer build him a bulky, rigid cylindrical casing which will protect his box of tricks under high pressure.

I should like to remark that the two features in particular which seem to me to make polyethylene so eminently suitable for submarine telephone cable insulation are low power factor and high breakdown voltage. I know this new material has a lower di-electric constant than gutta percha, but it is the high power factor of the latter material which rules it out. Submerged repeaters must, of course, be power fed and the cable may thus be under a constant stress of several thousand volts. I should like to ask Mr. Dean if he considers that by further processes of purification the power factor of gutta percha could have been materially reduced and its breakdown voltage raised.

I should also like to ask the lecturer, in relation to his remarks on knuckling and spewing, whether he does not think that by the devices that have been adopted—special conductors, special armouring or polyethylene cable—we have not, in fact, gone a good deal further than we ever did in gutta percha, and made polyethylene cable more immune than the old type was to faults arising from the stresses encountered in laying and picking up.

THE LECTURER: Dr. Smith has asked whether it would be possible, by purification or other process, to reduce the power factor of gutta percha to a figure more like that of polyethylene. No, I think not. I think the worst feature of the power factor of gutta percha is its variation with frequency, and the main advantage of polyethylene is not merely that it has a low power factor but that its power factor is constant with frequency.

As to the knuckling, I certainly think he is right. I think that the fact that the 1948 cable went wrong caused everyone to believe that polyethylene cable was no earthly good because it knuckled in deep water. Now I do not want to start an argument with any cable-laying engineer who might have been present on the *Monarch* at the time. There is no question but that the *Monarch* had to buoy the cable in 2,500 fathoms of water due to rough weather, and had to pick it up again, and that the cable was stressed beyond normal limits.

I agree with Dr. Smith that we put such an arduous test now on the cable as a control method that I think it is far better in this respect than any gutta percha cable ever was. I believe that a gutta percha cable under conditions applicable to the 1948 cable would also have gone faulty, but in a different way.

MR. M. S. BRAY: I should like to comment on Mr. Dean's remarks on knuckling and buoying. Certainly the cable was buoyed in very deep water, but I should not like it to be put on record that the *Monarch* had buoyed because of bad weather. In actual fact we had come up to that buoy after laying 1,000 miles of cable, and on that account this first section may have been buoyed rather longer perhaps than if it had been just a case of buoying-off because of weather.

THE LECTURER: Thank you. I am sorry if I misled the audience, but I was under the impression that it was because of bad weather that the ship stopped laying, although I bow to your superior knowledge that the main reason was because you came to the end of a length of cable. I think, however, that I am right when I say that there was very bad weather at that time.

MR. BRAY: Although I think the cable had been screwed off on the bottom, presumably by the motion of the buoy, we had been a thousand miles away and had no particular knowledge of the weather in the neighbourhood of the buoy.

THE CHAIRMAN: I should like to say first of all how very much we thank Mr. Dean for his most interesting and valuable lecture on a very topical subject to-day, and if we remember the reason for this meeting, which is the memory of Llewelyn B. Atkinson and his interest in the application of science to industry, particularly electrically, then you would agree with me, I am sure, that our lecture to-day has been very appropriate. We have had the good fortune to have a lecturer who, himself, has been most conspicuous also in the industrial applications of science in the electrical industry. Mr. Dean has himself said—as I was going to say with some pride—that we claim him amongst the ranks to which I belong, as a chemist—if only a relapsed chemist, as I am myself—but it is I think an interesting commentary on the interrelation of science and technology to-day that a chemist can give such a highly scientific lecture on the electrical industry as Mr. Dean's.

Submarine cables have for a century or more been a very great industry of this country and we have played a very great part in their development, both in the manufacture and in the laying, for many years, going back to the brave and spirited days of the *Great Eastern*. After that, we had many years of consolidation, when the world was laced together with underwater cables, nearly all of them made in this country. The companies which are now under Mr. Dean's chairmanship and their parents have had a very great past in this industry. It is, I think, most invigorating to know

that these same companies are playing a very great part in this same industry to-day and to know that Submarine Cables, Ltd. are at this very moment turning out some of the first miles of the new transatlantic telephone cable, for which they have secured the contract in face of world-wide competition. I think we should congratulate them on securing for us, all of us, the contract to produce the very great milage of cable which will be required for this new venture. Much of this success is, I think, Mr. Dean's personal success and he has been a very notable contributor in this field. His rise in his own companies has been on the technical side and he has risen through the various technical and scientific branches to the highest executive position. In the war he made many notable contributions through the medium of his companies to the development of radar, and it is true to say that he is the most distinguished figure in the cable industry.

Might I add a few personal remarks of my own relationship with him? In the 1930s, in the company to which I had the honour to belong, we were playing around with a new polyethylene substance. We did not know much about what we had got. We thought it had interesting properties, but we were not at all sure. This polyethylene was obviously of some interest electrically. Mr. Dean himself mentioned that one of our number—who, I might say, was trained in Mr. Dean's own company—referred to it as a possible synthetic gutta percha. But, as I say, we were rather speculating about it when Mr. Dean suddenly appeared on the scene and, with his knowledge and enthusiasm and great drive, was an enormous stimulus to the development of polyethylene in this country. Whereas we thought we might have got something, after the first twenty minutes of talking to Mr. Dean we knew we had, and we knew that with him we could make something of it.

The first piece of cable was made and put under water in his factory, I think, in the last month of 1937 or the beginning of 1938. I remember the first piece of power cable without a lead sheath, which Mr. Glass made almost personally with me and two others on a warm afternoon in 1939, and I believe I am right in saying that that cable, which was of an unprecedented design, is still working to-day. So we have had some adventures together, your lecturer and I, and I would say that he has contributed very notably to his industry and, in the bad war days, very notably to the defence of the realm and I think therefore that we are all very pleased to have heard what he has had to say and I would like to thank him very much.

The vote of thanks to the lecturer was carried with acclamation: and, another having been accorded to the Chairman, the meeting then ended.

THE BUYING AND SELLING OF ANTIQUES

A paper by

CECIL F. TURNER, C.B.E.,

read to the Society on Wednesday, 8th December, 1954, with Sir Ernest Goodale, C.B.E., M.C., a Vice-President of the Society, in the Chair

THE CHAIRMAN: One of the great attributes of this Royal Society for the Encouragement of Arts, Manufactures and Commerce is the extraordinarily wide vision that it can throw upon the affairs of daily life. The papers read at these meetings range from atoms to the sea and back again, and this afternoon we are going to hear a talk about the buying and selling of antiques.

Our lecturer, Mr. Cecil Turner, is a real expert on the subject, and has spent his life in the trade, or business, of buying and selling antiques. He has travelled widely in the United States and elsewhere. I think that perhaps one of his outstanding achievements is that he was responsible for the initial organization of the Antique Dealers' Fair, and for its progress year by year until he resigned last year from his chairmanship of the Organizing Committee. The Antique Dealers' Fair, I think, has done more for the industry than anything in recent years, and it is a great tribute to Mr. Turner's work.

The following paper was then read:

THE PAPER

The subject of buying and selling antiques and works of art embraces a very wide field, and covers a large and varied number of articles. It is international in its application, and dealers and collectors have existed from time immemorial in every country in the world. It would be impossible in the short time at my disposal to deal with other than the British antique dealers, who specialize in antiquities and works of art originally produced in this country, and in the vast collections assembled by our ancestors from all over the world, which provide a treasure house and source of supply that seem almost inexhaustible. It cannot be over-emphasized how great is our debt to those lovers of art, particularly in the seventeenth and eighteenth centuries, who during their travels abroad enriched the homes of this country by acquiring some of the finest works of art then produced in the various countries they visited, which in the course of time have become antiques. This country also has been most fortunate in the fact that during the seventeenth, and more particularly the eighteenth century, often justly referred to as the Golden Age of English craftsmanship, there existed not only great patrons of the arts, but craftsmen possessing the highest skill and great taste, whose productions in every field were prolific, thus providing a vast store from which to draw, and with which so many of our museums, art galleries and homes are now enriched.

One is frequently asked the question, 'Where do all the antiques come from? Is there no end to the supply?' It should be remembered that during the seventeenth and eighteenth centuries great numbers of fine mansions were built, some having as many as fifty or a hundred bedrooms, and six to eight reception rooms. It does not require too much imagination to realize that hundreds of pieces were needed to furnish even one such home. Owing to death duties and the incidence of excessive taxation, the contents of these homes have, in large measure, had to be sold and dispersed. Those that have survived constituted for the world a pattern of elegance and taste. In like manner, usually due to death, the contents of smaller homes come on the market from time to time. It can therefore readily be seen that there is, for various reasons, a constant change of ownership.

It would be impossible to speak, certainly impossible to speak with authority, on all articles that come under this heading, comprising as they do such things as furniture, silver, porcelain, pottery, glass, pictures, fabrics for upholstery, wall hangings and curtains, jewellery, carpets, bijouterie, and a host of other things. I therefore propose to confine myself to the buying and selling of furniture, porcelain, silver and pictures. However, in all branches of antique dealing many things apply in equal measure.

It would be as well to define what constitutes an antique, or in other words the date at which any article becomes an antique. The United States applies as the datum line for free entry of antiques and works of art into the States the year 1830, with a few exceptions, such as carpets, when the seventeenth century is the datum line; signed original contemporary works of art are also admitted free of duty. In this country the British Government rules that anything over a hundred years old may be termed an antique; the Dominions and Colonies concur in this with the exception of Canada, which fixes the year 1847 as the qualifying date; and most other countries use the hundred years old basis. It was the accepted practice of members of the British Antique Dealers' Association, who exhibited at the two 'Art Treasures' Exhibitions, to apply the datum line of 1830. It is also one of the regulations of the Executive Committee of the Antique Dealers' Fair and Exhibition held at Grosvenor House, Park Lane, in June of each year, that all exhibits must have been produced prior to 1830. This, which may appear to be an arbitrary datum line, is really based on sound reasoning; it is a dividing date between the age of hand craftsmanship and that of the machine age.

It may also be asked, 'What is the difference between an antique and a work of art?' I mention this because all over the country can be seen signs on the shops of various dealers stating that they deal in antiques and works of art. I offer as a suggestion that an antique can be anything over a certain number of years old, and need not necessarily be a work of art. Similarly, a work of art is anything that is beautiful in all its detail and a piece of fine craftsmanship, but need not necessarily be an antique. An object can, however, be both a work of art and an antique, and it is these that reputable dealers trade in, and that the public buy.

There is another aspect, and a very important one, to be considered from the dealers' point of view. While it is true that many dealers trade in articles seventy-five or a hundred years old, almost every dealer will prefer to buy pieces produced before 1830. I submit that, to the trained observer with fastidious eyes, the hands of a craftsman, in whatever field, build something into his work—endow it with a personality—which is almost unachievable by machine-made technique for similar articles. There is incalculable virtue in the hands; they are the creative outlook of a man's soul, his body and imagination, the inner joy of his being. No such reason, thought or joy reposes in the machine: its metallic temper can only be sustained by oil from a can.

During the last thirty or forty years there has grown up an enormous increase in the desire of the public to acquire antiquities. It is interesting to consider why this should be so. I do not think it is entirely due to the desire to invest in something that will not only keep, and in the course of time increase, its value, or the educational value of our museums, various art exhibitions and the Antique Dealers' Fair, but is an inner protest against the encroachment of the machine on our daily lives, good as it is sometimes. It has largely invaded our homes, and our thoughts and habits seem to be in process of surrendering to it. Fine works of art of bygone times enshrined in our homes can well impart some refreshment to us from the unyielding mechanics of present-day living, for if and when the machine completely occupies the home, and I hope the day is far distant, our individuality as humans will be smothered, our brains only responding to the booming of the wireless, and our stomachs conditioned to receive small doses of vitamin tablets. It is a sombre thought. Gone will be the gracious way of living, and all that is implied and carried with it.

I may in saying these things appear to be straying from the direction this paper should take, but consideration of modern tendencies is advisable in assessing the present-day background, for it is the dealers' concern to foster a revulsion of feeling to the influence of mass production in the world of art. I believe that a sincere approach to the acquiring or buying and selling of antiques, and works of art in particular, involves a study of the psychology which promotes the desire, and for this we must examine the background evolved over the centuries. We must bear in mind the factors which have contributed to this result, for the achievements of a nation in custom, government, and art are the spiritual tributaries of the river of its soul, and as such provide fertility for its growing. I hope this does not appear high sounding, but the urge to create and acquire beautiful things depends often quite unconsciously on an innate desire in most of us for that which is kindly and good, an inspiration inherent in our make-up.

What are, or should be, the qualifications necessary to become a good antique dealer? First and foremost, he or she must have a reputation for honesty and integrity. These are the only solid foundations on which to build any business; to inspire and retain confidence is half the battle in any trade dealings. Not so very long ago the antique trade was in large measure viewed with grave suspicion, and not altogether without reason. It lends itself to great temptation: the practice

of altering and embellishing a piece to make it more salable has persisted throughout the ages together with the making of absolute fakes, and probably it still does to some extent to-day. In 1918 many reputable dealers got together and decided something had to be done to stop, or at least discourage, this bad practice, which led to so much unfair competition and was a stumbling block hard to overcome. It was then that the British Antique Dealers' Association was founded: its objects are to assist and foster dealing in antiques, to protect the public against dishonest dealing in any form amongst its members, and to do all they can to discourage and suppress malpractice. These, coupled with the very strict rules governing the Antique Dealers' Fair and Exhibition at Grosvenor House, have over a period of years brought about a state of affairs which is paying handsome dividends. It has substituted confidence for suspicion and enormously increased the desire of the public to purchase antiquities.

The second qualification required by a good dealer is knowledge, which must be very extensive, and can only be obtained through years of study and experience in dealing. I do not suppose there is a dealer living who has not, during his career, made mistakes in judgment, and very valuable lessons can be learned from such mistakes. The acquiring of this knowledge is a life-long study; every year we discover something we have not known before, and the longer we trade the more it is realized how relatively small is our knowledge. It would be an impossibility for any man to acquire in a lifetime a thorough knowledge of all branches of art, and that is why almost all dealers specialize in one or two subjects only.

The next, profoundly important, qualification is that he must have a thorough training in design and period, to enable him correctly to date a piece. He must understand what constitutes quality, the difference between a fine piece and one of less merit. He must understand various woods, and why certain woods were used in one period, and not in another. He must be able to detect whether a piece was made in the period it represents to be, or at a later date. He must, or should have, a thorough knowledge of construction. He must be able to decide if a piece has been extensively repaired or altered from its original form. He must be able to distinguish and appreciate old patination. He must look out for the ravages of the wood worm in furniture, and know how to eradicate it. You may be interested to hear, in this connection, a story I heard the other day about two female wood worms, who were discussing the merits of their respective husbands. One was telling the other what a wonderful man her husband was, and went on at some length, until her companion began to get a bit restive and wriggling up on her end turned to the other lady to say, 'My dear, that's nothing, my husband is in antiques'. To resume, a dealer must be able to detect a fake. He must acquire a knowledge of values both for buying and selling, and lastly it is a tremendous help if he can acquire a fair knowledge of architecture and interior decoration.

If I may, I should like to enlarge and explain more thoroughly these various requisites. Let us first take training in design and proportion. The architecture and the furnishing of our homes were governed in every century by the prosperity

or the poorness of the country at the time, and to deal fully with these subjects would entail the preparation of one or two lectures in themselves. However, the influence of the prosperity or poverty of a country has always had a considerable effect on design. For the purpose of illustration I need only refer to the Queen Anne period, with its simplicity and its charm relying on proportion and the placing of veneers. The design of this period reflects the poverty and austerity of the country, particularly in contrast to the lavishness of the preceding Stuart and the succeeding Georgian eras. A dealer has to acquire a thorough knowledge of design in order to determine differences between the periods of Elizabeth I, James I, Charles I, Charles II, James II and William and Mary, all of which have much in common, and yet each differs in some form or other from its predecessor. Then again there is the even greater severity of the Cromwellian period. During the reigns of George I, II and III, there were a great variety of designs, including as they do the works of such well-known craftsmen and designers as William Kent, Chippendale, Hepplewhite, Sheraton and a host of others.

You will therefore realize the importance and the necessity of a reputable dealer making himself thoroughly conversant with this vast subject, to enable him correctly to date a piece and acquire a thorough knowledge and appreciation of design. He must train his eye to an appropriate appreciation of proportion, because correct proportion does greatly influence the design of a piece when viewed as a whole. It will, of course, be appreciated that some dealers trade in even earlier periods such as the Gothic and Medieval.

To appreciate that all-important question of quality, it is necessary to have some knowledge of construction. A piece to be of fine quality must be beautifully made, with regard, in the case of furniture, to such points as the excellence of the timber used, the dove-tailing of such things as drawer linings and the timber of which these are made, the selection and placing of veneers and inlays, the fineness of their detail and, in the case of carving, the fineness of its quality, its freedom and flow—just as the quality of a picture in large measure depends upon the flow and technique of the artist's brush; with the potter the artistic manner of his modelling and application of paint work is what counts; with the silversmith it is the fineness of his chasing and modelling; so also with carving wood which must show and possess the applied skill of a craftsman. To some extent, there exists a misunderstanding of what the word 'quality' means. A piece of furniture, for instance, can have excellent proportions, possess a beautiful colour, can be enriched with highly selected veneers, and yet fall down as a piece of quality because the drawers, for instance, may have been pine-lined instead of lined in oak or mahogany as the case may be, or the carcass generally poorly constructed.

It is essential to have a thorough knowledge of woods, to understand why certain woods were used in certain periods and not in others. May I give you a few examples of this? Most of our lovely Wren churches are enriched by oak, yet most of the carving of the period, especially the fine delicate carving by Grinling Gibbons, was executed in lime wood or pine, much softer woods than oak, making it possible for the craftsman to apply his great skill in obtaining fine

detailed effect. So in the eighteenth century, apart from other reasons, mahogany permitted the same technique to be applied in carving, it also being softer than oak. The beauty of effect in the eighteenth century furniture was obtained by the use of fine veneers and inlays of walnut, mahogany, satinwood, rosewood, kingwood, tulipwood, and various others. The cutting of these woods and placing of the veneers to form a pattern constituted a work of art in itself. It is important for the dealer to be able to distinguish veneers: for instance, in the case of walnut, that used in the seventeenth century, and that used in the Queen Anne and George I period; in the case of mahogany, both Cuban and Honduras, to distinguish that used in the early part of the nineteenth century, which had a different grain, a different texture; and to distinguish between satinwood and sycamore. He must know that certain woods were particularly used, that some were applicable only in the Chippendale period, and others in the Sheraton, but all for a definite purpose. It is sometimes difficult to determine if a piece was made in the period it represents itself to be: by this I mean that many pieces were made probably as copies of earlier pieces, by provincial craftsmen, as for example a piece made to the design of Chippendale of the date 1755–60. Pieces do exist which to the untrained eyes look as though they were made in 1755–60, but which were actually made at a date round 1800. It would take too long and probably bore you to explain at length how one determines this, but it is very important that the dealer should know, because it seriously affects, for one thing, the value of a piece.

I have already mentioned that a dealer must have a thorough knowledge of construction, and this is not only important to him as a means of determining date, but it also enables him to see if an original piece has been altered or extensively repaired—altered, for instance, to make it more salable, in the case of a plain piece, by the application of carving or inlay, or by the reduction of its size, either by its height or depth, and in some cases its length; in the case of later pieces, mouldings may be altered to those of an earlier period; or in both cases, there may be a removal of certain features. For example, alteration may consist in removing solid panels from doors and the substitution of glass or grilles, to enhance the appearance, and in innumerable other changes. He must also be able to know if a piece has its original patination, that is the surface of a piece which only age can give. It is rarely one finds such a piece which during its career, either through restoration or abuse, has not had the old patination removed or disturbed; but it is important he should know.

Any good dealer must be able to detect a fake, that is, in the case of furniture, a piece which has been made up, generally, but not always, by using old parts or old woods of the period. Fortunately for all of us, this is usually not difficult for the experienced to determine. The faker usually overreaches himself, goes too far, and puts in some detail which never originally existed, misses part of a detail which should have been included, or has been careless somewhere.

One of the most difficult things a dealer has to acquire is a knowledge of values, both for buying and selling. The antique trade is, I suppose, a unique trade; it is not like selecting from a manufacturer certain goods for resale

which depend on the demand for success, and if successful can be repeated. Every antique has some different characteristic, there are seldom two things alike, and it is on these differences that the dealer has to base his assessment of values. He has to determine several things: quality, condition, salability, and rarity, and how much the differences in design are worth. Something he has never seen before may give a piece 'a kick', and no two people, of course, ever think alike. What one man may think is fine quality and condition, and has just that something which makes it stand out above similar articles, another man may not appreciate, or miss, or he may just not agree. That is where the value of experience and of handling large quantities applies, coupled with the study of all those things necessary to qualify as a good dealer. Our trade is also unique in another way, that of inter-trading one with another. There are three sources of supply from which the dealer can draw upon to replenish his stock, private purchases, public auction and other dealers. It will be understood readily that it is quite impossible for one dealer to attend all the public auctions that take place all over the country in any one week of the year. Except for very important sales, dealers can only find time to view within a radius of about a hundred miles of their particular locality. In some cases, certain dealers have an arrangement with other dealers either to report to them any particular item of merit, or to give them the opportunity of purchasing items that have been bought at local sales, usually on a commission or small profit basis; in addition to this, most dealers from time to time make an extensive tour of the country, visiting other dealers' shops, and buying from them such pieces they see as will help to fill a demand that they may have. On the face of it, this would appear to boost up the price unnecessarily, but in actual fact it is not so. Were it possible for every dealer to attend every sale, some of the local dealers would not, in many cases, be able to purchase some of the things they now do, and they would be out-bid by their bigger brothers; so that by inter-trading prices are actually kept at a lower level. Further, a private buyer has not the time to run all over the country looking for a piece to fill his or her requirements, and usually asks a dealer with whom he or she is in the habit of trading to try and find such a piece, thus saving expense and, what is more, reaping the benefit of the knowledge and experience of the dealer with whom he or she may trade.

I have dealt at some length on the aspects of dealing in antique furniture and on the qualifications required of an antique dealer who is anxious to build up a good business and reputation. Before passing on to other branches such as porcelain, silver, pictures, etc., I must make a reference to another very important branch of the trade, repairs and restorations. It is understandable that articles made one hundred and fifty to three hundred and four hundred years ago must invariably, through the ravages of time and use, need a certain amount of restoration. If this were not done, very many beautiful things that now adorn our museums and homes would be lost to us by the natural process of decay. The question of restoration is a very difficult and exacting one; it requires great skill and the knowledge of how far to go and when to stop; it requires the selection of woods of the same period having the same figure and grain to match the

piece that is to be restored, as when replacing veneers, missing feet or handles, as in the partial re-gilding of mirrors, or the replacing of disfigured mirror plates. These are but a few of the items that occur in the dealers' every-day life. One sees so many lovely things ruined in poor restorations by removing the old patination of a surface and completely re-polishing a piece after repairs have been carried out, instead of skilfully matching up, as far as is humanly possible, the new work to the old without disturbing the latter.

I should now like to tell you a little of the difficulties with which the dealer in porcelain has to contend. I suppose china generally falls into two broad categories, that which is bought for domestic use or decoration on the one hand, and, on the other, pieces which are purely of interest to collectors. There must be many subdivisions of the latter category, some collectors specializing in the wares of certain factories and others forming more general collections—such as figures—from all factories. I can only say that a china dealer in a fairly large way will buy anything that he thinks may prove salable in any one of these departments, thereby building up a fairly big general stock which offers objects of possible interest to all kinds of buyers.

One looks for factory marks when one knows they might be expected to exist, but here again one cannot be really helpful by word of mouth since hundreds of pieces were produced without marks from most of the factories and obviously a faked piece is likely to bear a faked mark.

Variations of paste and decoration will enable the expert to distinguish most of the wares of the eighteenth century English factories; but this does not apply in the early nineteenth century when the bone-ash paste invented by Spode was in common use in dozens of factories and the painters were itinerant, so that their work may appear variously on the wares of almost any factory.

The question of re-decoration is another thorny problem which one meets, for instance, quite frequently in early Worcester wares, where sometimes pieces have been decorated outside the factory with more rare and desirable coloured grounds and then refired; but it really is not possible to demonstrate this particular problem by word of mouth.

Obviously one must be particular about condition also, since cracked or broken pieces except in the case of the greater rarities are generally undesirable. Modern methods of restoration make it necessary to examine every piece very carefully since a fresh restoration may not be immediately visible to the naked eye. An ultra-violet lamp which discloses such repairs immediately cannot very well be carried around all over the country.

You will see from what I have told you how many are the difficulties with which the porcelain dealer has to contend. He must, as in furniture and other branches of art, know the difference between a finely moulded piece and one of inferior merit. He must study and know the history of not only all the English factories but those of Continental Europe and the Far East. He must be able to distinguish the difference between pastes, know the names of modellers and artists and their particular characteristics, and also, as in furniture, be able to detect a fake or piece of later period. All this is a lifelong study.

Of all the articles which the Englishman has collected in his home over the centuries and of those he most treasures, silver probably takes the first place. The collecting of china, furniture or pictures is more of an acquired taste, but the family silver for its intimate associations is nearest the Englishman's heart. There are so many reasons which may be advanced for this: the history of the country, politically, financially and domestically, is written in its silver. Under the wonderful system of hall-marking which was established in the reign of Edward I and to-day exists in substantially the same form, an owner can trace the exact date of his silver, and in many instances the name of the craftsman. He has the guarantee under statutory authority that the quality of the silver is of a certain standard which is 'to be as good as the silver coinage or better'—well, you know what is the intrinsic value to-day of our coinage. The rules governing the hall-marking of silver are under the strict supervision of the various assay offices of whom the Goldsmiths' Company of London is the senior office. This is not the occasion for a dissertation on hall-marks and anyone who wishes to study the subject, the details of the various marks, the standard mark, the maker's mark, the date letter and the town mark, their reasons and history, cannot do better than get a copy of that splendid reference book *English Goldsmiths and their Marks* by the late Sir Charles Jackson. With all this, there is occasion for a special pride in the possession of old silver.

A word of warning might, however, be given here. Hall-marks, although they denote date and the quality of the metal, do not guarantee beauty of design, or even any standard of workmanship. In general the excellence of an article of silver is governed by the same laws which control other branches of decorative art.

Whether the individual is a collector of silver, furniture, porcelain or pictures there are certain fundamental conditions which must be fulfilled by him. He needs to study his subject to acquire knowledge. That knowledge will thus continually be improved and will develop in him a natural good taste, a retentive memory and a discerning eye. In silver, where there are many 'snags' to the uninitiated, an individual commencing to form a collection would be well-advised to buy only from well-established and reliable dealers. If he is of an adventurous disposition, wishes to exercise his own judgment, and is willing to pay for his mistakes, and he will surely make some, he should constantly have in mind 'caveat emptor'. This is not to impugn the honesty of any dealers but to point out that dealers have different degrees of knowledge and experience, and sometimes differing moral standards—in that respect they are not alone.

Over the years silver articles have not infrequently been altered to make them more useful to changing domestic conditions, for instance, a tankard may have added to it a spout to make it more useful as a milk jug. To conform to different fashions, an originally plain piece of plate may have been decorated with a design of chasing or engraving at a later date, or *vice versa*, while an ornamented piece may have had the decoration removed from it—'dechased' or 'erased' as it is termed in the trade. Again, there are instances where the silversmith may have used a piece of silver which had been hall-marked as part of

a light article and then inserted into a heavier article. Thus he would be saving the duty on silver which was levied at that time; 'duty dodgers' is the colloquial term for such articles. This condition sometimes exists in fine early pieces such as heavy cups or coffee pots which have been treasured possessions of important families. Unfortunately for the owners such articles do not conform to the hall-marking laws and if a piece came before the Goldsmiths' Company the old mark would be destroyed and the article re-assayed and stamped with to-day's mark; or, alternatively, the article might be destroyed. This might seem an arbitrary action on the part of the assay office but by its regulations it has no option in the matter. This duty dodging was comparatively frequent in the early part of the eighteenth century. Probably in some instances it might be that the silversmith inserted a mark he had on another article to save the trouble of sending a piece to the hall with all the delay which might ensue if the silversmith had to travel by horse-back from his home. Obviously some of these actions were not done with intent to deceive the client.

Referring to the 'duty dodgers', you might say that cups, sauce boats and tea pots were particularly subject to this attack, and the procedure sometimes was for the silversmith to insert a false bottom containing the hall-mark on to the article. Suspicion is aroused in that case by the hall-marking stamping not showing through the silver and the absence of any mark on the cover or lid. If there is any doubt the only course is to send the article to the assay office for a test. Chamber candlesticks have been turned into bread and butter plates by cutting off the candle-holder and hammering up the hole in the centre. Feet are added to the bottom of a soup tureen for the purpose of selling the article as a jardinière. Teapots, coffee pots, sugar basins and creams may be altered and decorated to make them match. Coffee pots or teapots which have been badly worn or damaged can have new bodies supplied to them. Rat-tails can be added to spoons and spoons can be altered into three-pronged forks. By cutting off the top half of a tankard it can be made into a sugar bowl or slop basin.

Except for the so-called 'period' fakes which have been referred to, these alterations and additions, de-chasing or erasing, inevitably destroy the old surface. In buying an early piece, a collector should therefore be particularly suspicious of an over-bright polish or of a new-like surface. This is not, however, always necessary as an article may have been highly polished over the years by the household servants. With tankards which have been de-chased, the original outline of the article is sometimes changed and a buyer may be suspicious of a flat tankard where the sides are inclined to bulge. But again this is not always justified.

Many articles which have seen hard wear over the centuries may be extensively repaired. Do not buy them. Others, such as tea and coffee pots and sauce boats, may have had patches in them to cover a weak spot or an erasure. Do not buy them. It may be said these latter are often difficult and sometimes impossible to detect except by the expert, as the surface may be plated over. If the surface is not plated, heavy breathing on the suspicious part may reveal the line of the soldering round the patch.

In addition to the above-mentioned irregularities there is the category of articles made with deliberate intent to deceive, such as those where the hall-marks have been transposed from a not very valuable piece into a modern and large article. For example, a section which included the hall-mark might be cut from a Georgian salt cellar and inserted into a modern coffee pot. These 'fakes' were carried out by highly skilled craftsmen and are sometimes difficult to detect. Then there are the forged hall-marks which are in themselves very clever work and not always easy to recognize. For the protection of the public salutory penalties can be enforced for such offences. The maximum penalty is life imprisonment—and on account of that and the vigilance nowadays of the Goldsmiths' Company, forging hall-marks has gone out of fashion. These are all neat pitfalls for the unwary and reinforce the advice to deal as far as possible only with those firms whose names are a warranty and will not even seek to evade responsibility if they make an error.

It may safely be said that reputable dealers will discourage their clients from purchasing speculative articles which are almost sure to prove in the long run a doubtful investment, they will be candid about the pieces they sell, and, in short, they will endeavour to give their clients a fair deal. After all, there is no especial virtue in being honest and it is always good business to be so and act so. It may be of interest to know that there is a special committee in London of members of the silver trade and representatives of the museums which is appointed by the Goldsmiths' Company and which meets regularly to consider difficult problems of authenticity of silver and its marks. This committee is some protection and help to dealers as well as to the public.

I have told you of just a few of the pitfalls which the public may fall into. The job of the dealer is to study and learn, usually the hard way from experience, so that when a client enters the shop of a reputable dealer he can do so knowing that what he is shown has undergone the test of the dealers' knowledge; he can then buy with complete confidence.

Anybody who makes up his mind to be a picture dealer must also make up his mind that he has a long period of training before him: in fact, to be successful, he has to go on learning all his life. The eye can best be trained by constantly looking at the best pictures. There is no substitute for this; no amount of reading of books, of attending lectures or of conversation about pictures can make up for the patient study of the best pictures themselves, though all these other methods of study are of great help to the understanding and enjoyment of the pictures when we do look at them.

How, it may be asked, are we to know which are the best pictures? At first, until we have gained experience, we may safely trust to the reputation the pictures have acquired in the eyes of the picture lovers and critics of the past and present. The extreme example of how *not* to look at pictures is furnished by the story of the gentlemen from the provinces who with his wife and family had made a very rapid tour of the Tate Gallery. As he approached the exit turnstile, he said in a loud voice: 'Well, I don't think much of that lot; I could have done that better myself'. An attendant, who no doubt supposed he was

being addressed, quietly approached the visitor with the words: 'Here, sir, it is not the pictures which are on trial, it is the people who come to look at them'.

Anybody, whether he be a dealer, large or small, or a buyer, such as a museum director, a private collector or even a buyer of one picture, or a person of some or no culture wishing to enhance his enjoyment and understanding of life, has much to learn from looking at the best pictures in public galleries or private collections. First, by so doing he will train his eye to appreciate some of the many qualities which are to be found in a great work of art. Here it may be pointed out that we cannot expect to find more than a few qualities in any one picture. The thing is to recognize and appreciate those qualities and *not* to regret the qualities which are not there and were probably never intended by the artist to be there. Secondly, our student will gradually learn to recognize the period in which a picture was painted and in many cases its country of origin or school. Thirdly, the work of an increasing number of artists will begin to become familiar so that faced with a picture which he has not seen before by an artist some of whose work he already knows, he will be able to recognize the painter of this particular picture. It would probably be generally agreed that there are two stages in this recognition, though with those of much experience the two stages may often be almost simultaneous. The first stage is one of general recognition, as we might recognize a friend's handwriting by a glance at an envelope. The second stage is in a sense a check of the first and consists in recognizing certain characteristic details, remembered from other pictures by the same artist.

A question that experts are constantly asked is: 'How do you *know* that this picture is by so and so?' The least unsatisfactory answer to this question is probably to ask another: 'How do *you* know that that back you see fifty yards down the street is the back of Michael Brown, whom you haven't seen for five years?'

Most private buyers, realizing that they cannot possibly know as much about these matters as dealers who spend their lives at it, rely very greatly on dealers of good reputation for guidance and advice. For though a prospective buyer may have trained his eye for a time in the way indicated above, there are, for the unwary, traps which the reputable dealer will enable him to avoid.

Let us suppose that our amateur takes a liking to a picture which purports to be by a well-known seventeenth-century artist. If he is buying from a reputable dealer he should know that he is in fact getting a picture by the artist in question in good condition and not:

(*a*) A modern copy (made by some modern artist without intent to deceive).

(*b*) A modern fake (made dishonestly with intent to deceive).

(*c*) An old copy or fake made (say) in the eighteenth century.

(*d*) A contemporary picture painted by a pupil or other artist under the influence of some powerful artistic personality like Rembrandt or Hals.

(*e*) A contemporary picture painted in the studio of some great and overworked artist like Rubens or Van Dyck, mainly or entirely by pupils with or without touches by the master and under his supervision.

The above possible alternatives to genuineness are listed roughly in order of difficulty of detection.

It is sometimes stated that there is a lot of snobbery about big names in the buying of pictures and there is some truth in this statement. It is not the dealer who is responsible for such snobbery but the public. It would suit the dealer very well if he could successfully present a picture saying: 'Here is a fine seventeenth-century picture—I haven't the slightest idea who painted it—it is worth £2,000'. The trouble is he would never sell it. The public insist on names.

Next in importance to the question of authenticity is the question of value—and a highly complicated question it is. People sometimes ask: 'How much is a Van Dyck (or whatever it may be) worth?' This is not really a very much more intelligent question than: 'How long is a piece of string?' For the value of a picture depends on many factors—its composition, colour, draughtsmanship, light and shade, size, attractiveness, history and, especially, that almost indefinable factor called 'quality' of paint. It depends on all these factors as well as on the reputation of the artist.

A few general principles may be laid down. We most of us do not appreciate the products of the two generations or so immediately preceding our own, and it therefore takes about a hundred years from the time it was painted for the value of a picture to find its level. Fashions in pictures which have been painted at least a hundred years do not vary nearly as much as is often supposed.

The remarks which follow refer entirely to pictures at least a hundred years old. In process of time they rise steadily or violently in value and this for two chief reasons: over a period of years the value of money decreases; there is, that is to say, an inflationary tendency and the value of pictures with other solid property therefore increases; secondly pictures gradually find their way into museums or (very rarely) are destroyed and so the possible number by an artist that can come into the market is constantly reduced.

As time goes on the gap in value between the best works of any particular school or artist and the less good increases, and it therefore pays to buy the best of its kind: it is wiser to buy a first-class picture by a second-class artist, rather than a third-class picture by a first-class artist. More and more attention is paid to condition; badly damaged pictures are wanted less and less.

A collection of pictures, in aggregate, is always worth more than the total of the value of each individual picture if each picture were owned by a different person. It follows, therefore, that the addition of (say) a seventh good picture to a collection of six good pictures of more or less similar period or school increases the value of the additional seventh picture *and* that of the original six.

It was indicated above that the prudent buyer will always seek the help of a reputable dealer from the point of view of authenticity. Still more will he be wise to do so from the point of view of value.

I have dealt at some length with the difficulties with which a dealer has to contend in buying antiques and the knowledge it is necessary for him to acquire. Before concluding this paper I should like to say a few words on the selling angle, which will of course embrace that of buying by the public.

There are two ways in which an article can be sold, by high pressure salesmanship, or by the art of selling to satisfy a demand, and giving lasting pleasure in doing so to the buyer. There is no question to my way of thinking that the latter method is the only one worth pursuing, and at the same time the dealer obtains the self-satisfaction of doing a job well. A dealer can get just as much pleasure in finding an article to fill a much needed want, particularly if this is difficult, as does the client who buys it. Many friendships have been formed between dealer and client this way.

Those of us who have formed the habit of collecting antiques usually start off in a small way, because of the appeal, the romance and history attached to them, as well as an innate desire to possess lovely things; and eventually we become 'bitten with the bug', which eats more and more into our systems. As we progress our taste and knowledge improve and increase, we become dissatisfied with the pieces we first bought, and we want to replace them with better and finer things, so far as our pockets will allow.

This brings me to the point I should so much like to impress on those who have heard me read this paper, and those who may read it in print. It should, from the beginning, be the aim of every buyer to acquire only the best of its kind however humble it may be, or however low in price. The same rule should equally apply as we buy better and better things; it should be instilled in our minds that the remembrance and lasting effect of quality remain long after the price is forgotten.

So many of the public spend their time, and I think to no purpose, in hunting for bargains, but gone are the days when this was possible: the advent of the motor car has been the instrument which has brought this about. One has only to attend the smallest of sales in the most out-of-the-way places to see a dozen or two dealers who may have come to buy just one piece of merit in such a sale. How often we come across people who in asking the cost of, say, a bow-front chest of drawers, the price of which is £50, turn round and remark, 'Why, I saw one the other day like that and the price was only £25'. Such people do not seem to realize that most dealers know their business, and are unlikely to sell anything for £25 worth £50 and, further, that they would be glad to pay more than £25 for one worth £50 in order to secure it. Of course, one can buy a chest of drawers at various prices, just as one can buy any other commodity, but nowadays nothing good is cheap, in whatever field. For the serious buyer, this should be of great importance, because, if and when the time comes when he or she might wish to sell, they would always find a buyer for a good article, and quite likely in the course of time would get more than was paid for it, whereas he or she would be lucky not to make a loss on one of inferior merit.

I should like to suggest, with respect, that anyone interested in purchasing antiques should place himself or herself in the hands of a dealer of good repute, and tell him what he can afford to pay and what he wants to collect. Insist only on buying things of fine quality, and ask if a piece has been restored or altered in any way and, as a means of protection, ask the dealer to give a written guarantee of genuineness and to put a *circa* date on his invoice. Any good dealer

will be glad to do this; it is a protection for the buyer and can only inspire confidence in the dealer.

I have endeavoured to the best of my ability to give you, by what I have said, some idea of the difficulties with which dealers have to contend in the pursuit of their calling, and the knowledge it is necessary to acquire before one can qualify as a dealer of repute. It may perhaps have surprised many of you, but I have come across people who have said, 'I should like to be in your business, all you have to do is to buy something you fancy and sell it'. This I hope you have gathered is far from the case. A dealer performs a public service: he is the medium for calling attention in very many instances to fine works of art and antiquities, which are acquired by our museums and art galleries; he does much work in collecting, and in assisting private buyers to assemble their collections large and small; he goes to a great deal of trouble and expense, and places at the disposal of his clients the benefit of his knowledge and experience hardly come by, and hardly worked for. It is, I think, one of the most fascinating occupations in the world; we are constantly brought in touch with beautiful and lovely things, and it is instructive to the mind, satisfying to the eye, and affords inestimable pleasure.

I should like to express my thanks to Mr. Bernard Perrett, Mr. John Hodges, and Mr. Hugh Agnew, who have so kindly assisted me with data on porcelain, silver and pictures respectively.

In conclusion I should like to say how much I appreciate the honour in having been asked by our Chairman, Sir Ernest Goodale, to read this paper to the Royal Society of Arts. Those of us who are so fortunate as to receive and read the various papers and lectures printed in its most excellent journal cannot feel anything but gratitude for the manner in which it fosters and encourages all branches of art and industry. It broadens our minds, is most instructive, and inspires in all of us an endeavour to give of our best and to make perfection our aim in all that is best and worthwhile in life.

DISCUSSION

THE CHAIRMAN: We have all heard of the Iron Curtain, some of us have heard of the Bamboo Curtain, and this afternoon we have had a pair of antique curtains drawn aside to show us something behind the scenes of the business of buying and selling antiques. I am sure that we are all very grateful to Mr. Cecil Turner for his extremely instructive paper.

MR. F. C. WINBY: I wonder if the lecturer would tell us from which direction we are likely to find the most frauds? I might tell you that some time ago I was in a continental town, which I read in the guide book was noted for its ancient workers in leather. I bought a kind of portfolio-wallet in leather and was pleased with it. Some time after, I saw a stamp in the corner 'Made in Birmingham'.

THE LECTURER: I do not suppose there is one particular aspect of the art world, whether silver, porcelain, pottery, furniture, pictures, glass, tapestries or fabrics, that has not had the attention of the faker and the maker of reproductions, but I do not think there is one specific field that is worse than another. One should be very careful in forming a collection and in buying things. It is far better, as I have

stated, to go to somebody with real knowledge—and by that I do not mean one's friend who has a collection and a reputation for having nice things. Quite frequently, not always, but quite frequently they have no knowledge whatsoever, and it can be very misleading for the buyer.

MR. SIDNEY T. LAUGHTON: Could the lecturer tell us what has influenced the change of taste in America over the last thirty years? I believe that about twenty years ago Tudor furniture was extremely popular, but that it is now a drug on the market. Was the change of taste influenced by our clever salesmen who went there? I was there about thirty years ago, and I saw a most beautiful carved Court cupboard. The owner in Philadelphia at the time of Prohibition kept his 'hooch' in one of the cupboards, and in order to make it more practical he had bored a hole through the carving and put a Yale-lock on it.

Another point I would like to make is that the names of Chippendale, Hepplewhite and Sheraton are most attractive and come tripping off the tongue. Now, if a lady described a beautiful sideboard as by Ince and Mayhew or by Mainwaring, would it have the same poetical signification?

THE LECTURER: Answering the first part of the question, the taste in antiques in the last thirty years has been governed really by the change in the mode of living. Thirty years ago large numbers of people could afford to have bigger homes and the staff to run them, which is not so to-day. The present tendency is for smaller rooms, smaller houses and smaller apartments, and therefore the tendency is to furnish those particular homes with smaller fittings. In the Stuart and the earlier oak periods, most furniture was inclined to be large, and therefore it is not so suitable.

With regard to the second point, I think that any dealer or collector would be just as happy, if not happier, to possess a piece marked or stamped Ince and Mayhew as he would if it were by Chippendale, Sheraton or Hepplewhite. There were a number of very fine cabinet makers in the eighteenth century, and for those who are interested, there is a most excellent book giving dozens of names of those craftsmen, by Sir Ambrose Heal. But a work of art is a work of art irrespective of the artist. If it is fine, it always will be fine.

MR. G. W. PHILLIPS: I should like to ask the lecturer for his views on the lamentable loss of antiques from this country to countries abroad.

THE LECTURER: The questioner no doubt refers to the number of articles which have, over a period of years, been going to the United States. The United States has been doing what we did in the seventeenth and eighteenth centuries. There has been a drain, but I think that the exchange of antiques and works of art all over the world is good, educationally, morally and financially. It will probably relieve the questioner's mind when I tell him that only this last week the British Government gave permission for the supply of currency to purchase antiquities from America, Canada or from any other hard-currency area in the world, and so we can hope that in the course of time the flow will steadily come back to this country.

MR. E. HANCOCK: Could the lecturer tell us if a piece of furniture can be faked so well that it will deceive the eye of an expert?

THE LECTURER: You know, that word 'expert' is a very difficult word to define. I might consider myself an expert, but my contemporary competitor might think that I do not know what I am talking about and vice-versa! I suppose it is possible for a fake piece of furniture to deceive the expert, but I am quite certain that it is not possible to fake any piece of furniture to deceive every expert.

MR. G. A. LUCAS: The lecturer referred to 1830 as the datum line for antiques as far as the antique dealers were concerned, and attributed that to the introduction of

machinery. Surely that is a relatively minor point; surely the line is drawn there because of the debasement of design and art generally?

THE LECTURER: I think that one has to be kind. I believe I said, when referring to pictures, that it takes at least one hundred years before any work of art of any period or century can be appreciated. I would rather not express my own views with regard to the question. There is a great deal of substance in what the questioner said, but the real factor governing the choice of 1830 is the difference between hand- and machine-made articles.

THE CHAIRMAN: I am sure you would wish me, on your behalf, to extend to Mr. Cecil Turner a very warm vote of thanks for the fascinating paper that he has read to us this afternoon. He has obviously given us of his great erudition in this subject, has told us a great deal and warned us about the pitfalls of picking up antique bits and pieces here and there. I am sure that you would wish to show your warm thanks for his paper.

The vote of thanks was carried with acclamation, and the meeting then ended.

GENERAL NOTES

EXHIBITION OF PICTURES FOR SCHOOLS

The eighth annual exhibition of pictures for schools organized in London by the Society for Education for Art is to be shown at the Whitechapel Art Gallery, High Street, E.1. These exhibitions consist of original works of art specially chosen as being suitable for schools. They provide local education authorities and schools with an opportunity to buy contemporary works and many hundreds have been so bought in previous exhibitions.

The exhibition will open on the 5th and close on the 27th February. Admission is free. The gallery is open on weekdays, except Mondays, from 11 a.m. to 6 p.m., and on Sundays from 2 to 6 p.m.

SHORT NOTES ON BOOKS

HUMPHRY DAVY: 'PILOT' OF PENZANCE. *By James Kendall. Faber*, 1954. 10*s* 6*d*

This short biography of the chemist who became the rage of London before he was thirty and to whose lectures Coleridge used to go merely to 'increase his stock of metaphors', describes his life, his quarrels and his discoveries from the safety lamp to Michael Faraday.

A GLOSSARY OF CHINESE ART AND ARCHÆOLOGY. *By S. Howard Hansford. The China Society*, 1954. 15*s*

This glossary is addressed to readers of Chinese who require precise definitions of technical and conventional terms met with in current writings on art and archæology and also to those, already familiar with Chinese arts, craft and antiquities, who have embarked on the study of the written language. There are 112 drawings to illustrate the text.

TEACH YOURSELF TO STUDY ART. *By D. Talbot Rice. English Universities Press*, 1955. 6*s*

This book, in addition to giving an outline history of the chief schools of art, attempts to answer the questions why pictures have been painted and why we should look at them, and discusses patronage, taste, the value of representation, and matters of art study. There are twenty-four pages of half-tone plates.

INTRODUCTION TO TYPOGRAPHY. *By Oliver Simon. Penguin Books*, 1954. 3*s* 6*d*

In this revised edition of a book published in 1945, rules of composition are laid down, the choosing of type and the setting of the text, from title page to index, and the questions of illustration and binding are discussed. There is a bibliography and an index and many illustrations in the text.

METALWORK AND ENAMELLING. *By Herbert Maryon, F.S.A. Chapman & Hall*, 1954. 36*s*

This is the revised edition of a book first published in 1912. It is 'a practical treatise on gold and silversmiths' work and their allied crafts', and it covers the points which arise in all technical aspects of jewellers' work. There are 333 line drawings by Cyril Pearce and 35 half-tone plates.

ENGLISH MEDIÆVAL ARCHITECTS. *By John Harvey. Batsford*, 1954. 75*s*

This is a biographical dictionary of English architects, master masons, carpenters, carvers, building contractors and others responsible for design down to the year 1550. There are a topographical and a general index, and several appendices.

FROM THE JOURNAL OF 1855

VOLUME III. *26th January*, 1855

THE FACTORY SYSTEM IN THE UNITED STATES

There was lately opened at Lawrence, Massachusetts, a New Hall, in connection with the Pacific Mills, which is quite a new feature in the factory system. Here it is expected that during each week there will be provided, free to all of the operatives of these mills, a lecture or a concert, or some pleasing and profitable exhibition. It was hoped that the future would prove the existence of *sympathy* for the interest of all engaged in the service. On the occasion the operatives assembled to the number of 800, and were addressed by Mr. W. Chapin, the resident agent of the corporation, who proceeded to describe some of the distinctive features of the Pacific Mills. The *library* contained 1,500 carefully selected volumes, 500 of which were in constant circulation. This was open to all on the payment of a single cent each week. Then there was the *Relief Society*, which was essentially peculiar to this establishment. Every one of the employed, over 14 years of age, is required to give from his wages two, four, or six cents per week, unless the fund become too large; and in case of sickness he has proper medical attendance, of his own choice, free of expense, and a proportionate allowance of 1 dollar 25 cents to 3 dollars 75 cents per week during sickness, even if it should extend to six months; 125 persons had received the benefit, and upwards of 1,100 dols. had been distributed, while no one person had contributed more than a single dollar to the fund. The *Savings Bank*, connected with the cashier's office, where sums from five cents to 100 dols. and more, were received, and an annual six per cent. interest allowed, was distinctive, yet it was gratifying to know that this corporation was not alone in adopting such a means of good to its workpeople. Upwards of 10,000 dols. had been deposited by the operatives in six months. The *Boarding Houses* contained unusual provisions for health and comfort, but were susceptible of improvement. Mr. Young, treasurer and general agent, then made a few remarks, averring that here was proof that a corporation sometimes has a soul.

Some Activities of Other Societies and Organizations

MEETINGS

MON. 7 FEB. Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. *The Problem of Radio Interference* (Discussion).

Geographical Society, Royal, South Kensington, S.W.7. 8.30 p.m. Duncan Carse : *South Georgia Survey.*

TUES. 8 FEB. Civil Engineers, Institution of, Great George Street, S.W.1. 5.30 p.m. C. D. C. Braine : *The Effect of 'Storage' on Sewage Design.*

Manchester Geographical Society, 16 St. Mary's Parsonage, Manchester, 3. 6.30 p.m. Mrs. C. M. Gordon : *Ceylon.*

Textile Institute, at Electricity Showrooms, Union Street, Oldham. 7.30 p.m. H. L. Muschamp : *Modern Aspects of Yarn Winding.*

At the Municipal Technical College, Bolton. 7.30 p.m. R. Gill : *Sizing of Synthetic Fibres.*

WED. 9 FEB. Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. (1) J. K. S. Jowett and G. O. Evans : *A Study of Commercial Time Lost on Transatlantic Radio Circuits due to Disturbed Ionospheric Conditions* ; (2) A. M. Humby, C. M. Minnis and R. J. Hitchcock : *Performance Characteristics of High-Frequency Radio Telegraph Circuits.*

Engineering Inspection, Institution of, at the Royal Society of Arts, W.C.2. 6.45 p.m. C. J. F. Tanner : *The Future Role of Inspection.*

Mechanical Engineers, Institution of, 1 Birdcage Walk, S.W.1. 6.45 p.m. *The Use of Models* (Discussion).

Newcomen Society, at the Science Museum, South Kensington, S.W.7. 5.30 p.m. A. Raistrick : *The Mechanisation of the Grassington Moor Mines, Yorkshire.*

Petroleum, Institute of, 26 Portland Place, W.1. 5.30 p.m. C. G. Williams : *Applicational Research in the Petroleum Industry.*

Victoria & Albert Museum, South Kensington, S.W.7. 6.16 p.m. F. J. B. Watson : *English Villas and Venetian Decorators.*

THURS. 10 FEB. Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. R. W. Palmer : *Maintenance Principles for Automatic Telephone Exchange Plant.*

Fuel, Institute of, at the Institution of Civil Engineers, Great George Street, S.W.1. 5.30 p.m. E. M. Edwards, W. T. Hird, S. L. Wright and T. S. Ricketts : *Wales Gas Board—Integration of Fuel Supplies.*

FRI. 11 FEB. Mechanical Engineers, Institution of, 1 Birdcage Walk, S.W.1. 5.30 p.m. L. W. Bryant and C. F. Cowdrey : *The Effects of Velocity and Temperature of Discharge on the Shape of Smoke Plumes from a Funnel or Chimney.*

SAT. 12 FEB. Horniman Museum, London Road, Forest Hill, S.E.23. 3.30 p.m. G. F. Eades : *The Story of Forest Hill, Dulwich and Sydenham.*

MON. 14 FEB. Building Centre, 26 Store Street, W.C.1. 6.30 p.m. James C. Kennedy : *Teamwork in the Industry : The Job—the Importance of a good start.*

Chadwick Trust, at the Royal Institution of Great Britain, 21 Albemarle Street, W.1. 5.30 p.m. Sir Hugh Beaver : *Clean Air.*

Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. *Teaching Faraday's Law of Electromagnetic Induction* (Discussion).

Transport, Institute of, 66 Portland Place, W.1. 5.45 p.m. Sir Arnold Hall : *Influence on Civil Aviation of some Current Researches.*

TUES. 15 FEB. Civil Engineers, Institution of, Great George Street, S.W.1. 5.30 p.m. F. Tattersall, T. R. M. Wakeling and W. H. Ward : *Investigations into the Designs of Pressure Tunnels in London Clay.*

Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. W. E. Harris : *The Service Engineer at an Atomic Energy Establishment.*

Industrial Transport Association, at the Royal Society of Arts, W.C.2. 6.30 p.m. C. Dandridge : *The Railway Outlook of To-day.*

Manchester Geographical Society, 16 St. Mary's Parsonage, Manchester, 3. 6.30 p.m. Showell Styles : *Travels in Nepal.*

Textile Institute, at the Midland Hotel, Bradford. 7.15 p.m. P. P. Townend : *Wool Combing.*

WED. 16 FEB. Archæological Institute of Great Britain and Ireland, Royal, at the Society of Antiquaries of London, Burlington House, Piccadilly, W.1. 5 p.m. B. Colgrave : *Northumbrian Life in the time of the Venerable Bede.*

British Kinematograph Society, at G.B. Theatre, Film House, Wardour Street, W.1. 7.30 p.m. Harold Huth : *The Impact of Television Films.*

Victoria & Albert Museum, South Kensington, S.W.7. 6.15 p.m. F. Sherwood Taylor : *Decorative Design in Early Scientific Instruments.*

THURS. 17 FEB. Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. (1) P. J. Bhatt : *An Introduction to the Study of Servo-Mechanisms* ; (2) E. J. Davies : *The Development of 50 c/s Traction in France* ; (3) G. Gascoigne : *Electricity Applied to Oil Production.*

Road Transport Engineers, Institute of, at the Royal Society of Arts, W.C.2. 6.30 p.m. F. Lawrence : *Some Trends in vehicle C.I and petrol engine lubrication.*

FRI. 18 FEB. British Sound Recording Association, at the Royal Society of Arts, W.C.2. 7 p.m. H. A. M. Clark : *Electro-acoustics of Microphones.*

Mechanical Engineers, Institution of, 1 Birdcage Walk, S.W.1. 5.30 p.m. Prof. L. J. Kastner and T. J. Williams : *Pulsating Flow Measurement by Viscous Meters with Particular Reference to the Air Supply of Internal Combustion Engines.*

SAT. 19 FEB. Horniman Museum, London Road, Forest Hill, S.E.23. 3.30 p.m. A. J. Arkell : *The Magical Statuettes of Ancient Egypt.*

OTHER ACTIVITIES

NOW UNTIL 10 FEB. Royal India, Pakistan and Ceylon Society, at the Imperial Institute, South Kensington, S.W.7. *Exhibition of Paintings from Classrooms of the East.*

NOW UNTIL 12 FEB. The Crafts Centre of Great Britain, 16/17 Hay Hill, W.1. *Exhibition of Decorated Glass and Books.*

MON 14 FEB. UNTIL 12 MAR. Sanitary Institute, Royal, at the Museum of Hygiene, 90 Buckingham Palace Road, S.W.1. Exhibition : *You Versus Pests.*

NOW UNTIL 19 FEB. Solid Smokeless Fuels Federation, at Charing Cross London Transport Station. *Exhibition of Solid Smokeless Fuels and Appliances.*

NOW UNTIL 20 FEB. Royal College of Art, at the Victoria & Albert Museum, South Kensington, S.W.7. *Exhibition of Fine Arts.*